11-6660-228-10

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

OPERATOR'S MANUAL
RADIOSONDE SET AN/AMT-4D
(NSN 6660-00-542-1964)

Headquarters, Department of the Army, Washington, DC
14 May 1975

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*This manual supersedes TM 11-6660-228-10 23 March 1962, including all changes.

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CHAPTER 1
INTRODUCTION
Section I. GENERAL

1. Scope

This manual describes Radiosonde Set AN/AMT-4D (radiosonde) (fig. 1-1) and covers its installation and operation.

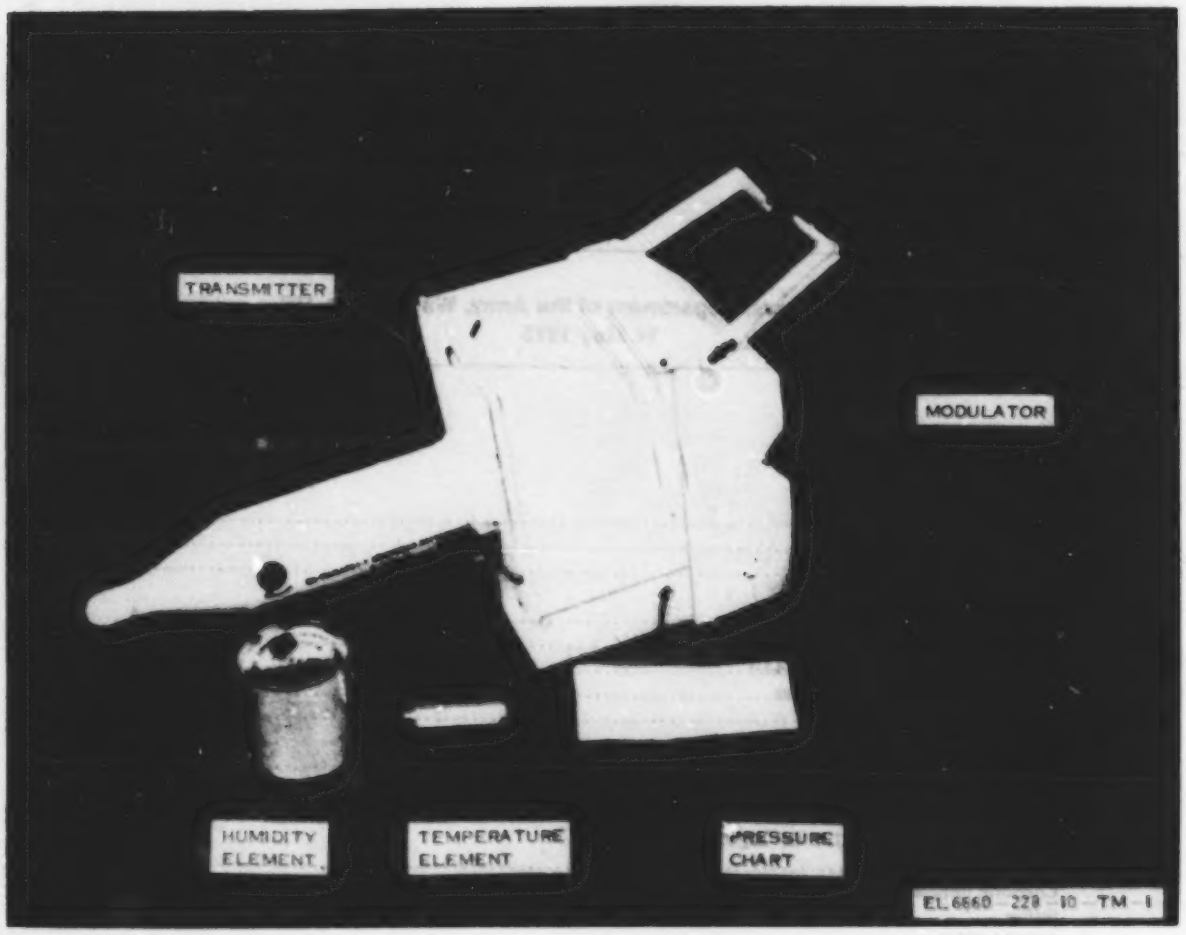

Figure 1. Radiosonde Set AN/AMT-4D.

2. Forms and Records

a. Reports of Maintenance and Unsatisfactory Equipment. Use equipment forms and records in accordance with instructions in TM 38-750.

b. Report of Packaging and Handling Deficiencies. Fill out and forward DD Form 6 (Packaging Improvement Report) as prescribed in AR 700-58/NAVSUPINST 4030.29/AFR 71-13/MCO P4030.29A, and DSAR 4145.8.

c. Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33A/AFM 75-18/MCO P4610.19B, and DSAR 4500.15.

d. Reporting of Equipment Publication Improvements. The reporting of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications and Blank Forms) and forwarded direct to Commander, US Army Electronics Command, ATTN: AMSEL-MA-Q, Fort Monmouth, NJ 07703.

3. Indexes of Publications

a. DA Pam 310-4. Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

b. DA Pam 310-7. Refer to DA Pam 310-7 to determine whether there are modification work orders (MWO's) pertaining to the equipment.

Section II. DESCRIPTION AND DATA

4. Purpose and Use

a. Purpose. The radiosonde is a balloon-borne, battery-powered meteorological instrument that automatically transmits radio signals relating to the pressure, temperature, and humidity of the upper air to ground-receiving equipment.

b. Use.

(1) Signals transmitted by the radiosonde are received by a rawin set (TM 11-6660-206-12) which is connected to a radiosonde recorder (TM 11-6660-204-12). The recorder prepares a flight record on calibrated graph paper that is used to evaluate the information received from the radiosonde. Wind direction and speed data are furnished by the rawin set from the rise and horizontal drift of the radiosonde.

(2) Meteorological data provided by the radiosonde are used for analyzing and forecasting weather conditions, guiding aircraft planning missions for aircraft, and preparing ballistic correction data for the effect of the atmosphere on the trajectory of artillery projectiles, missiles, and rockets.

5. Technical Characteristics

a. Radiosonde.

Range of measurements:

Atmospheric pressure	1,060 millibars to 5 millibars.
Temperature	+60° C to -90° C.
Relative humidity	0 to 100 percent.
Accuracy:	
Atmospheric Pressure	±4 millibars.
Temperature	±1° C.
Relative himidity	±10 percent.
Distance range[1]:	
Altitude	100,000 feet (30, 480 meters) maximum.
Horizontal	125 miles (201, 125 meters) maximum.
Power supply voltages	115 vdc, 6 vdc, and 1.5 vdc. (Battery Pack BA-259/AM).
Approximate weight:	
Less battery	710 grams.
Including battery	1,105 grams.

b. Modulator.

Meteorological elements:

Temperature	thermistor. (Resistance varies inversely with temperature).
Humidity	Hygristor. (Resistance varies directly with humidity.)
Atmospheric pressure	Aneroid capsule.

c. Transmitter.

Frequency range, T-435/AMT-4B	1,660 to 1,700 mc.
Preset frequency	1,680 mc ±4.
Type of output	Pulse.
Pulse repetition rate	5 to 200 pps.
Antenna	Dipole, current-fed.

6. Table of Components (AN/AMT-4-D)

The items listed in table 1 make up an operable radiosonde.

[1]These distances are approximate. They will be determined by surrounding terrain and windspeed.

Table 1. Items Comprising an Operable Radiosonde Set AN/AMT-4D

National stock number	Item	Quantity	Common name
6660-00-863-8131	Modulator, Radiosonde MD-210B/AMT-4B	1	Modulator
6660-00-542 1993	Transmitter, Radiosonde T-435A/AMT-4B1	1	Transmitter
6660-00-752-7258	Temperature Element, Resistance ML-419/AMT-41	1	Temperature element
6685-00-863-4801	Humidity Element, Resistance ML-476/AMT-4	1	Humidity element
	Pressure calibration chart	1	Chart

7. Expendable Consumable Supplies

The following items are expendable consumable supplies:

a. 1 tube of silicone compound (NSN 5970-00-224-5277).

b. 1 package wiping tissues.

8. Description of Radiosonde

a. The radiosonde includes a modulator, a transmitter, a temperature element, a humidity element, and accessories.

b. After assembly in the field, the radiosonde is made part of a system in conjunction with other equipment (para 11) to measure and record atmospheric pressure, temperature, and humidity.

c. A detailed description of the components and accessories of the radiosonde is included in paragraph 9 and 10.

9. Description of Components

a. Modulator. The modulator (fig. 2) is enclosed in a white plastic case. Two pivoted temperature element arms (fig. 7) are fastened to the top of the case and have temperature element clips attached to retain the temperature element in position during flight. The humidity element clips are attached to a humidity element shield which is mounted on top of the case. A battery compartment door at the bottom of the case provides access to the battery compartment and retains Battery Pack BA-259/AM. The door also contains mounting facilities for the transmitter. All operating controls are located on the pressure switch (fig. 4).

b. Transmitter. The transmitter (fig. 2) is housed in a tabular, white plastic case. One end of the case is tapered, and the other end contains a mounting rim for attaching the transmitter to the modular. The leads used to connect the transmitter to the modulator extend from the base of the transmiter and are terminated in two plugs. Openings in the side of the transmitter case permit adjustment of the transmitter frequency.

c. Temperature Element. The temperature element (thermistor), a ceramic-type resistor, varies inversely in resistance with changes in temperature. The body of the temperature element is coated with a waterproof, white material that is an efficient reflector of solar radiation. Leads are provided for attaching the temperature element to the temperature element clips on the modulator.

d. Humidity Element. The humidity element (hygristor) is a carboncoated plastic strip with metallic electrodes on its two long edges. The resistance of the carbon deposit between the electrodes varies directly with humidity and, to a lesser extent, with temperature changes of the atmosphere. The humidity element is fastened to clips beneath a shield on top of the modulator.

e. Pressure Calibration Chart. Each pressure switch is tested for pressure in millibars versus commutator contact segments. The results of this test are printed on the pressure calibration chart and included with the modulator containing the tested pressure switch. The pressure calibration chart is used during station pressure adjustment (para 20) and evaluation of the radiosonde flight.

10. Description of Accessories

a. Wiping Tissues. The wiping tissues are used to clean the commutator of the pressure switch and the temperature and humidity element clips.

b. Silicone Compound. The silicone compound is used to insulate against electrical leakage on the outside of the modulator case.

11. Additional Equipment Required

The following equipment is not supplied with the radiosonde but is required for proper operation.

a. Battery Pack BA-259/AM.

b. Meteorological balloon, inflating and launching accessories, and parachute (TM 11-6660-218-12).

c. Radiosonde Baseline Check Set AN/GMM-1 for AN/GMM-1A (baseline check set) (TM 11-6660-219-12).

d. Rawin Set AN/GMD-1A or AN/GMD-1B (rawin set) (TM 11-6660-206-12).

e. Radiosonde Recorder AN/TMQ-5, AN/TMQ-5A, AN/TMQ-5B, or AN/TMQ-5C (recorder) (TM 11-6660-204-10).

f. Test Set TS-538/U, TS-538A/U, TS-538B/U, or TS-538C/U (test set) (TM 11-6625-213-12).

12. Differences in Models

There is one model.

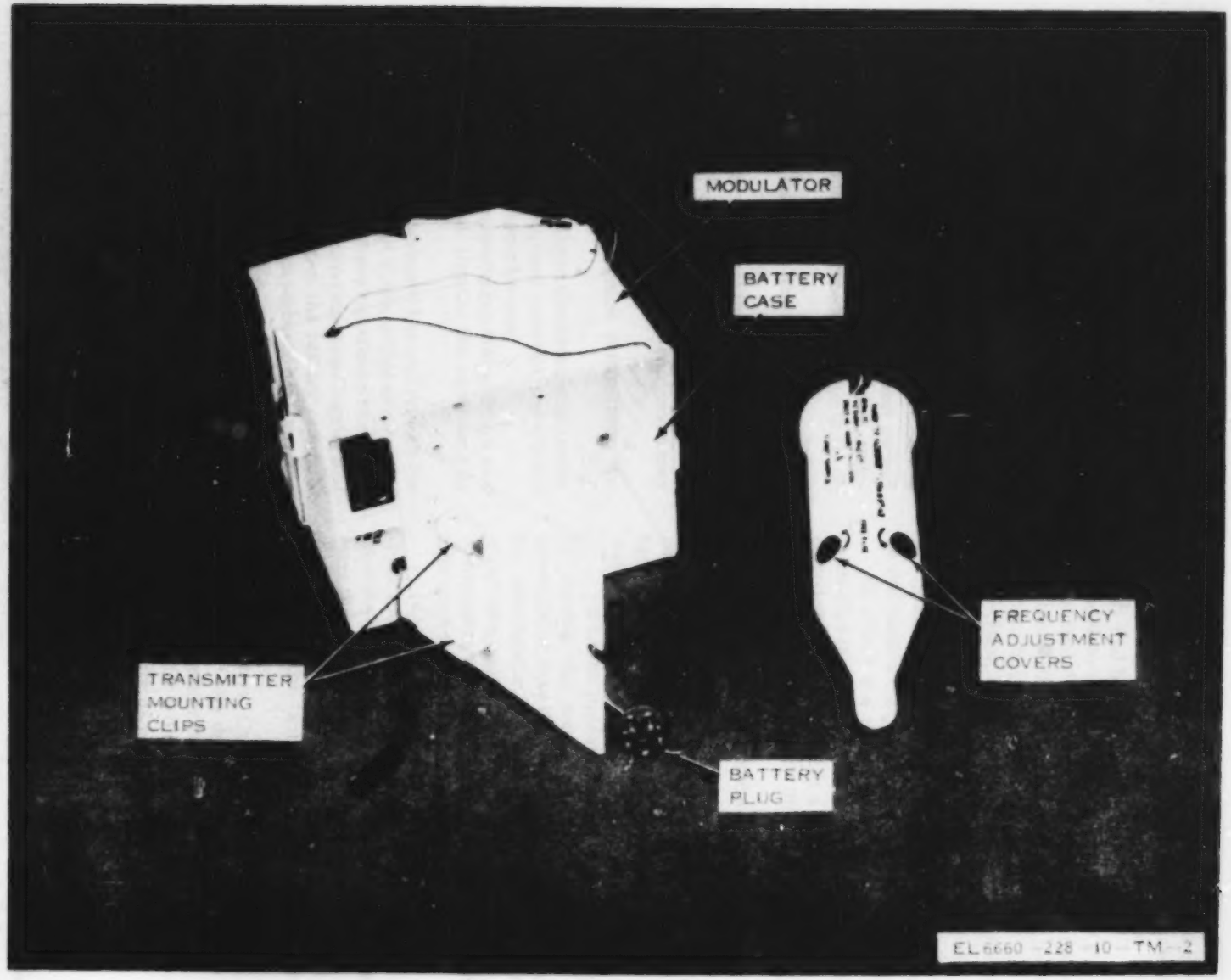

Figure 2. Modulator and transmitter.

CHAPTER 2
SERVICE UPON RECEIPT OF EQUIPMENT

13. Unpacking

(fig. 3)

a. Packaging Data. When packaged for shipment, the components of 24 radiosonde sets are placed in a corrugated carton. For oversea shipment, the corrugated carton is then packed in a wooden packing case. The dimensions of the corrugated carton are approximately 28 by 25 by 21 inches, the volume is 8.5 cubic feet, and the weight is approximately 50 pounds. Packaging details of the corrugated carton are shown in figure 3.

b. Removing Contents. Perform all the procedures outlined below when unpacking equipment packed in a wooden packing case. When unpacking equipment in cartons, omit the procedures given in (1), (2) and (3) below.

(1) Cut and fold back the metal straps (not shown).

(2) Remove the nails from the top of the wooden packing case (not shown) with a nailpuller and remove the cover. Do not attempt to pry the cover from the case because damage to the equipment may result.

(3) Remove the corrugated carton from the wooden packing case.

(4) Cut the tape and open the corrugated carton.

(5) Remove the technical manuals, the silicone compound, and the wiping tissues.

(6) Remove the prepackaged transmitters and modulators as required. Unpack the equipment as follows:

(a) Open the paperboard box and remove the wrapped transmitter. Cut the tape that secures the corrugated wrap and remove the transmitter.

(b) Open the moisture-vaporproof barrier and remove the modulator. Open the battery compartment door and remove the paperboard box. Open the box and remove the contents.

NOTE

The pressure calibration chart must remain with the modulator in which it was packed. If the chart is missing, do not use the modulator.

14. Checking Unpacked Equipment

a. General.

(1) Inspect the contents of the carton for loss or damage incurred during shipment. If any components are damaged or missing ((2) below), refer to paragraph 2.

(2) Check the equipment against the packing list. When no packing list accompanies the equipment, the table of components (para 6) may be used as a general check to indicate the equipment which probably had been packed.

b. Modulators. Check the modulator, the humidity element, and the temperature element as indicated below. If any discrepancies are noted, do not use that component but refer to paragraph 2.

(1) Check the serial number on the pressure calibration chart against the serial number on the modulator in which the chart was packed.

(2) Check the transmitter mounting clips (fig. 2) on the battery compartment door for damage.

(3) Check the temperature and humidity element clips (fig. 6 and 7) for damage or corrosion. If corroded, polish them with a wiping tissue.

(4) Open the top of the modulator and check the following:

(a) Check the pressure switch (fig. 4) for obvious damage.

(b) Check the commutator for corrosion. If corroded, polish the commutator with a wiping tissue. Be sure to rub in a direction parallel to the segments.

(c) Lower the contact arm to the commutator by moving the contact arm lifter toward the commutator; note the position of the contact arm on the commutator. Manually move the contact arm about two contact toward the higher end of the commutator (right side) and release it. The contact arm must return to its original position.

(d) Turn the modulator upside down and check to see that the contact arm does not fall away from the commutator. Raise the contact arm lifter to raise the contact arm from the commutator.

(5) Check to be sure that the humidity element and the temperature element containers are sealed.

c. Transmitters. Check the transmitter as indicated below. If any discrepancies are noted, do not use the transmitter but refer to paragraph 2.

(1) Check for a damaged case or cover gasket.

(2) Check for damaged leads or plugs.

15. Siting

The launching site of the radiosonde set is determined by the location of the rawin set. Refer to TM 11-6660-206-10 for information concerning siting of the equipment.

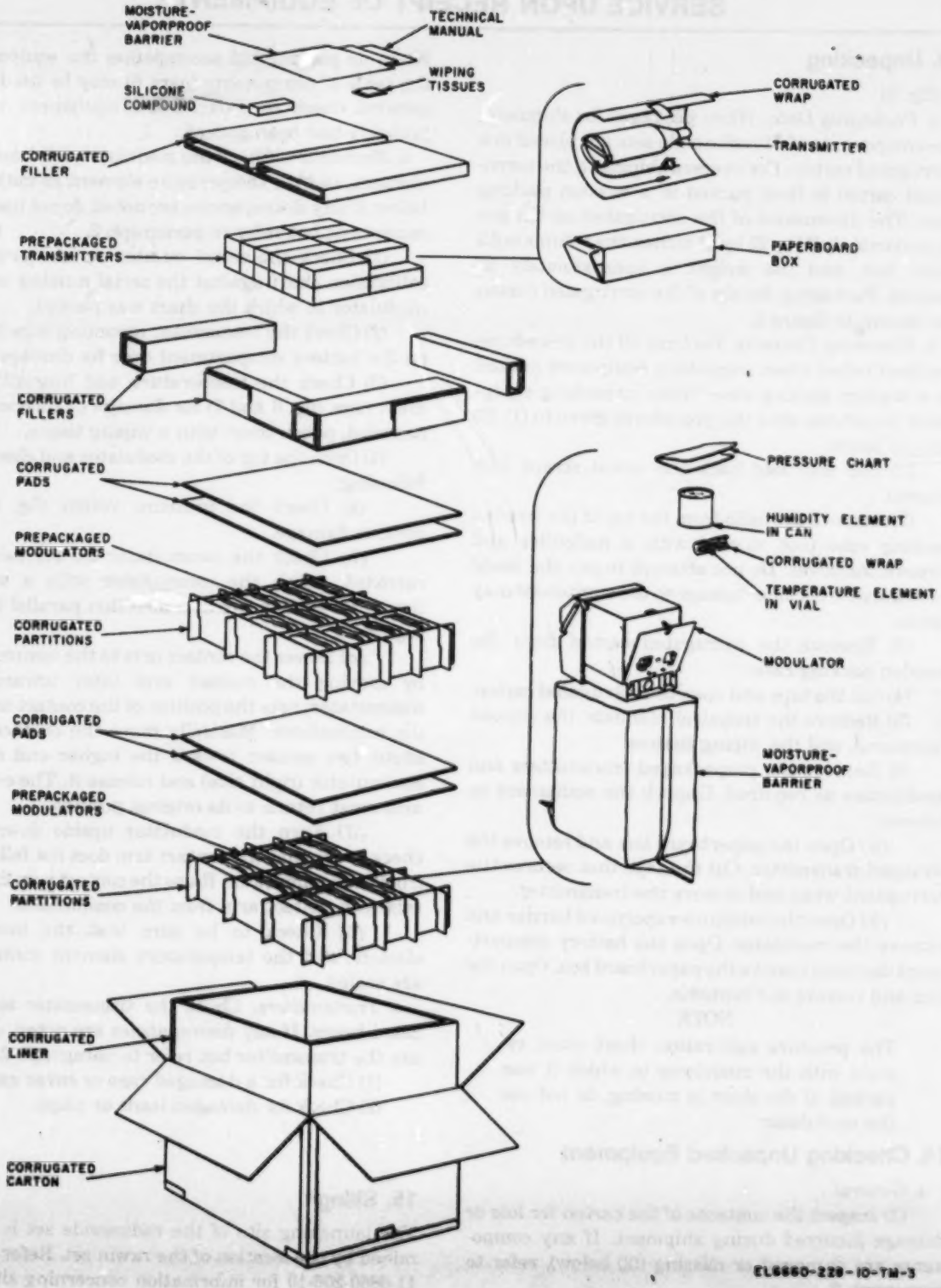

Figure 3. Packaging diagram.

CHAPTER 3
OPERATION

16. Controls

Table 2 lists the modulator controls and functions.

Table 2. Modulator Controls and Functions

Control	Function
Contact arm lifter (fig. 4)	Lowers or raises contact arm.
Commutator adjustment wheel	Adjusts position of commutator with respect to contact arm.
Frequency adjustment screw (fig. 2)	Raises or lowers Frequency of transmitter. (Turning in direction of arrow on transmitter case raises frequency.)

17. Assembly of Radiosonde

a. Mount the transmitter to the modulator by following the procedures given below.

(1) Slide the transmitter base into the mounting clips on the battery compartment door.

(2) Feed the transmitter cables through the notch (fig. 5) on the side of the battery compartment door.

b. Connect the transmitter power connector (fig. 5) to the power receptacle on the modulator. Connect the transmitter input connector to the modulator output receptacle.

c. Activate Battery Pack BA-259/AM according to the instructions on its label. Connect the battery connector to the battery receptacle and install the BA-259/AM in the battery compartment; follow the instructions on the battery label.

CAUTION

A new battery may be required for flight if the baseline check exceeds 30 minutes. The time capability of the battery to sustain in flight operation is reduced approximately 1½ minutes for each minute the radiosonde flight is delayed after the battery has reached full activation.

d. Close the battery compartment door.

e. Install the humidity element and the temperature element (para 18).

18. Installation of Humidity Element and Temperature Element

If the radiosonde flight is for the purpose of obtaining meteorological data, install the humidity element and the temperature element as indicated in *a* through *g* below. If the radiosonde flight is for the purpose of obtaining wind information only, install the fixed resistor (27,000 ohms) in place of the temperature element (*f* below); do not use the temperature element or the humidity element.

a. Disengage the front of the humidity element shield (fig. 6) from the top cover. The mounting pins on the rear of the shield will act as a hinge.

b. Pivot the humidity element shield to expose the humidity element clips. Apply a thin coat of silicone compound between the humidity element clips; be careful not to get the silicone compound on the clips.

CAUTION

Do not touch the center-coated portion of the humidity element. With hands free of silicone compound, handle the humidity element by the outer metallized edges. Do not allow the humidity element to come in contact with silicone compound, since this will render the humidity element useless.

c. Remove the humidity element from the humidity element container.

d. Install the humidity element between the humidity element clips. Lower the humidity element shield and snap it into its normal position.

CAUTION

Handle the temperature element by wire leads. do not touch the body (white-coated portion) of the temperature element.

e. Remove the temperature element from the temperature element vial.

f. Raise the temperature element arms (fig. 7) and connect the temperature element to the temperature element clips.

g. Apply silicone compound on the outside of the modulator cover between the temperature element arms.

19. Checking Radiosonde

a. Check and calibrate the rawin set and the recorder (para 11).

b. Install the radiosonde set in Radiosonde Baseline Check Set AN/GGM-1 or AN/GMM-1A (TM 11-6660-219-12).

c. Use Test Set TS-538/U, TS-538A/U, TS-538B/U, or TS-538C/U, (TM 11-6625-213-12) to check the transmitter frequency. The frequency indicated must be the assigned station frequency ±4 megacycles (mc).

d. If the transmitter frequency is not within the tolerance given in *c* above, adjust the transmitter frequency by following the procedures given below.

(1) Remove both frequency adjustment covers (fig. 2) and turn each frequency adjustment screw

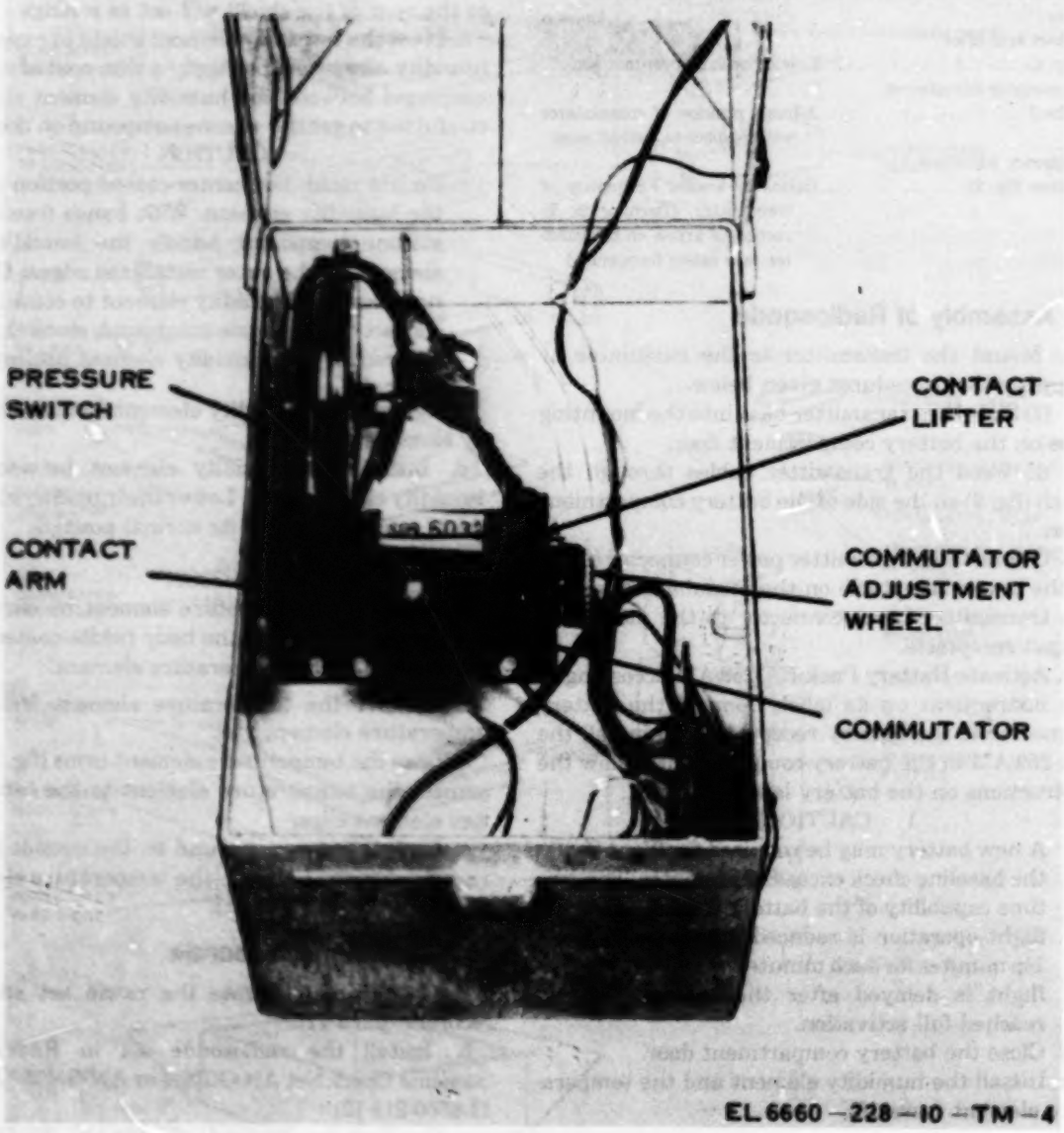

Figure 4. Modulator Controls.

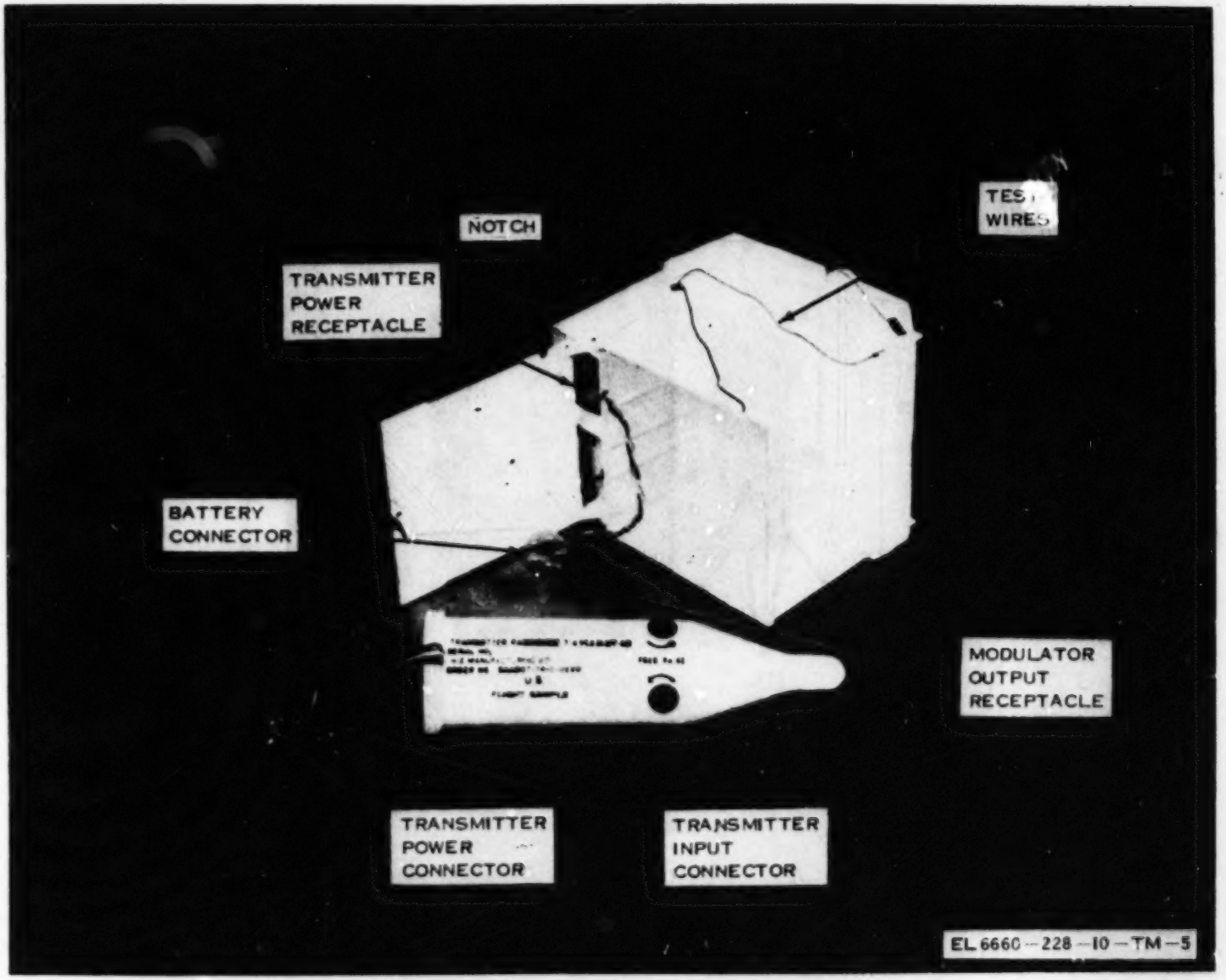

Figure 5. Radiosonde wiring.

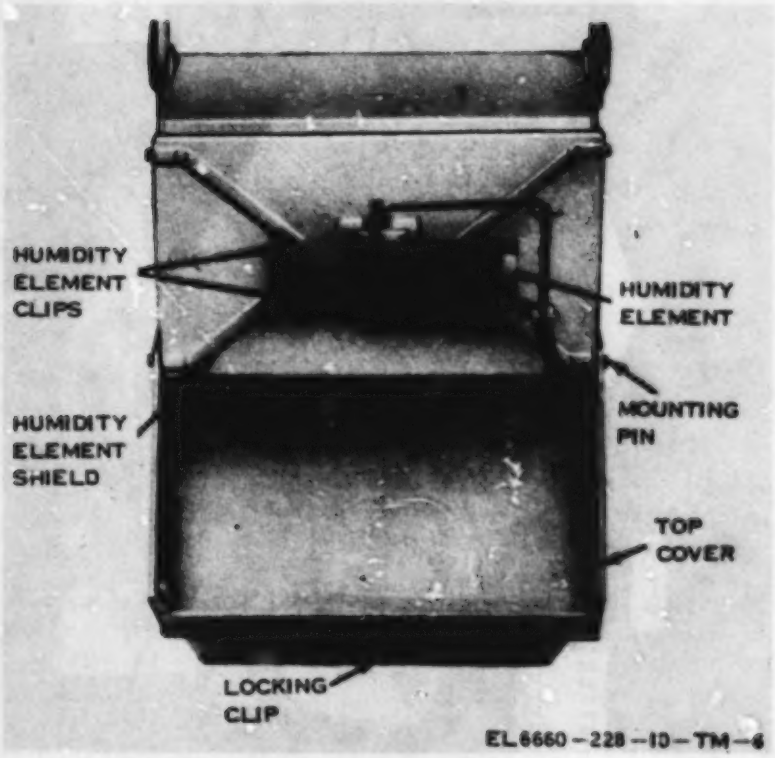

Figure 6. Humidity element installation.

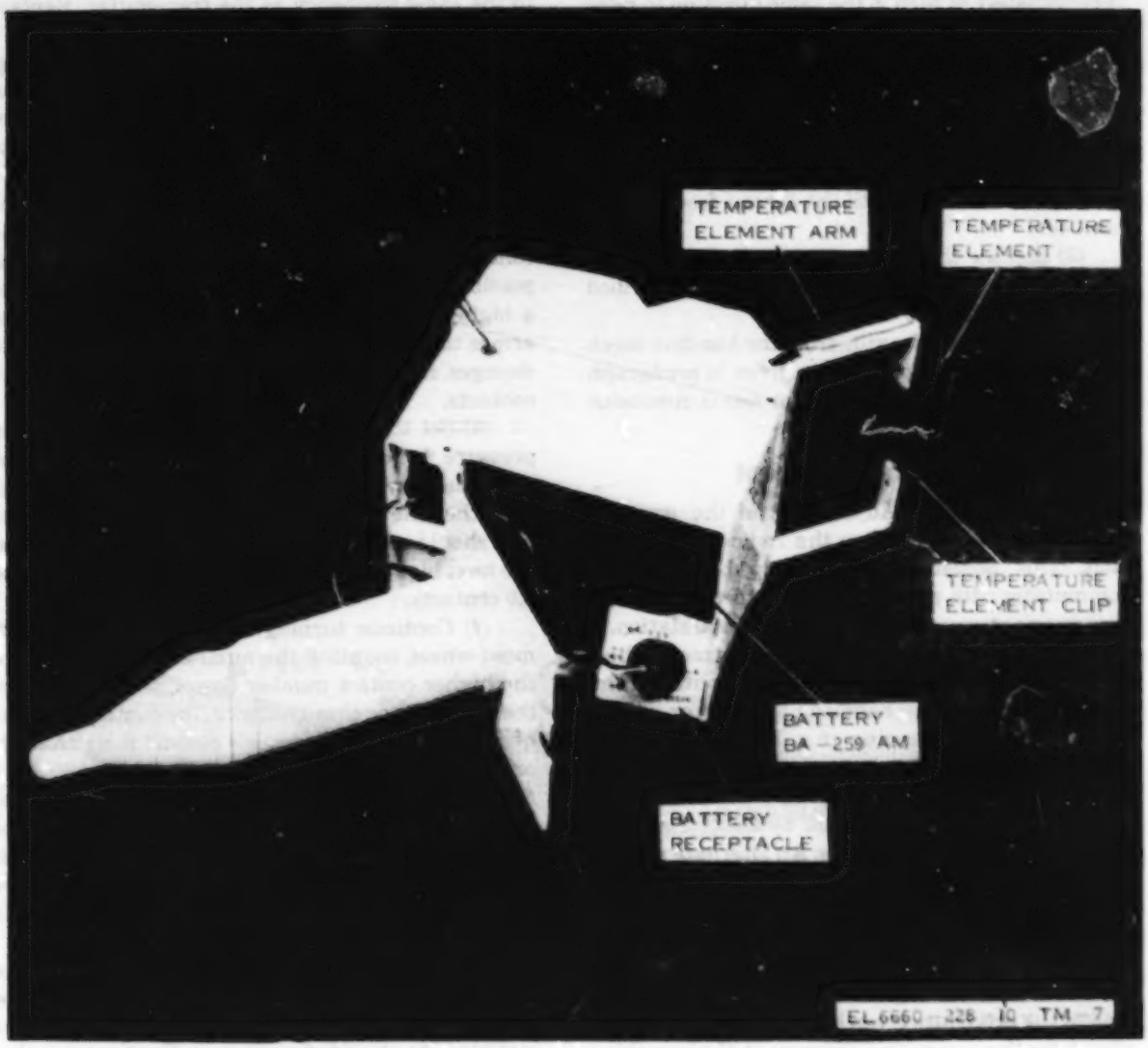

Figure 7. Temperature element installation.

approximately ¼ turn in the same direction to raise or lower the frequency.

(2) Turn the screws in the direction indicated by the arrow on the transmitter case to raise the frequency, or in the opposite direction to lower the frequency. If, after the initial adjustment the frequency is still not correct, turn each screw slightly in the same direction until the correct frequency is reached.

(3) Replace the frequency adjustment covers.

e. Perform the baseline ground check as described in TM 11-6660-219-12.

f. Remove the radiosonde from the baseline check set and perform the procedures given in paragraph 20 to set the contact arm on the proper commutator contact.

20. Pressure Switch Adjustment

a. General (fig. 4). Adjustment of the pressure switch is performed before the radiosonde is sent aloft. This adjustment accurately positions the commutator with respect to the contact arm for the barometric pressure at the meteorological station. A detent action of the commutator adjustment wheel permits accurate positioning of the commutator. The detent consists of the notched commutator adjustment wheel and a spring that bears against the wheel. Each click represents a specific movement of the commutator with respect to the contact arm. Adjustment of the commutator by use of the sound method is described in *b* below. An alternate method for adjusting the commutator is the use of the baseline check set and is referred to as the light method; this method is described in TM 11-6660-219-12.

b. Commutator Adjustment by Sound Method. Follow the procedure given below to set the pressure switch for the barometric pressure at the launching site.

(1) Use the barometer at the launching site to determine the ground barometric pressure.

(2) Open the top cover (fig. 6) of the modulator and lower the contact arm (fig. 4) onto the commutator by moving the contact arm lifter toward the commutator.

(3) Use the pressure calibration chart (fig. 9) bearing the same serial number as the modulator, and find the contact number corresponding to the barometric pressure at the launching site. Pressure values are given as direct milibar readings under the contact numbers.

(4) Listen to the speaker on the rawin set. A tone should be heard. If no tone is heard, check the frequency of the rawin set to be sure that it is tuned to the same frequency as the transmitter. Replace the transmitter if the tone is not heard.

(5) Turn the commutator adjustment wheel (fig. 4) to the position the commutator (fig. 8) so that the contact arm is on the next higher numbered contact ((3) above), which is multiple of 5. Turn the wheel to the right to position the contact arm.

Example. If the station pressure requires that the desired contact arm setting be 6.4 contacts, the contact arm should be initially set visually as close as possible to 5.0 contacts. Listen for the tone change, to a higher pitch, when the commutator adjustment arm is turned by the operator. The instant the tone changes, *stop!* The contact arm is now resting at 5.0 contacts.

(6) Set the contact arm to the desired station pressure by continuing to turn the commutator adjustment wheel in the same direction ((5) above) until the tone changes *twice*, then *stop!* The contact arm should now be on the edge of the contact nearest the next higher numbered contact, which should be 6.0 contacts.

(7) Continue turning the commutator adjustment wheel, counting the number of clicks, toward the higher contact number (lower pressure). When the audible tone changes twice, the contact arm has been positioned *one complete contact more* than its original position ((6) above).

Example. The contact arm originally positioned at contact 6.0 has had two changes in the audible tone and is now positioned at 7.0 contacts. Assume that 36 clicks of the commutator adjustment wheel were counted in this process when moving from 6.0 to 7.0 contacts.

(8) Reverse the turning of the commutator adjustment wheel so the contact arm will be positioned to the lower numbered contact (6.0). The audible tone should change once. Continue turning the wheel until the tone changes again, then stop! The contact arm should now be positioned *one complete contact less* than orginally positioned ((7) above).

CAUTION

It is important that the operator make the last contact arm adjustment toward the direction of the higher contact number (lower pressure); otherwise, slack in the tension of the contact arm will cause errors in the pressure tabulations when the radiosonde flight is released.

(9) It was assumed that the number of clicks counted between 6.0 and 7.0 and vice versa from 7.0 to 6.0 contacts was 36. The station pressure used in the example above required the contact arm to be

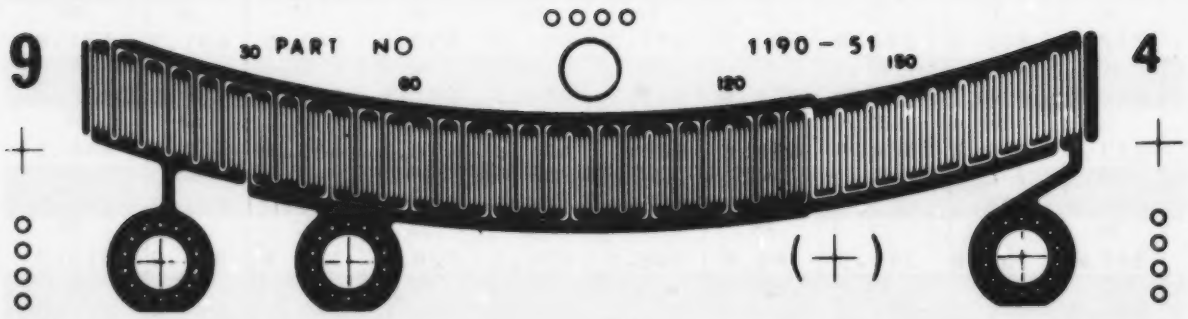

Figure 8. Commutator.

BAROSWITCH PRESSURE CALIBRATION CHART

DATE _____ RELEASE TIME, G.M.T. _____ SOUNDING NO. _____

STATION COMPUTED NO. DETENT CLICKS _____

BAROSWITCH SERIAL NO. 610 – 9987 DETENT CLICK VALUE .60

10	11	12	13	14	15	16	17	18	19
946.3	931.3	919.3	907.3	895.3	883.8	869.3	858.3	846.8	835.8
30	31	32	33	34	35	36	37	38	39
712.3	702.3	691.8	682.3	672.3	662.8	650.8	641.3	631.8	622.8
50	51	52	53	54	55	56	57	58	59
523.3	512.8	504.8	496.8	488.8	481.3	470.8	463.3	455.8	448.3
70	71	72	73	74	75	76	77	78	79
367.8	359.8	353.3	346.8	340.8	334.3	328.3	322.3	316.3	310.3
90	91	92	93	94	95	96	97	98	99
247.8	242.8	237.8	233.3	228.3	223.3	217.8	213.3	208.8	204.3
110	111	112	113	114	115	116	117	118	119
159.8	155.3	151.8	148.8	145.3	141.8	137.8	134.8	131.3	128.3
130	131	132	133	134	135	136	137	138	139
97.3	94.3	91.8	89.3	87.3	84.8	82.3	79.8	77.3	74.3
150	151	152	153	154	155	156	157	158	159
47.8	45.3	43.3	40.8	38.8	36.3	33.8	31.3	29.3	26.8
170	171	172	173	174	175	176	177	178	179
.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

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Figure 9. Pressure calibration chart.

positioned at 6.4 contacts. The difference (0.4) times the number of clicks (36) equal 14 clicks (rounded off to the nearest whole); therefore, the operator must turn the commutator adjustment wheel *toward the higher contact number* (lower pressure) until 14 clicks are counted. The contact arm should now be positioned at 6.4 contacts as stated in the example above.

(10) Close the top cover and secure the modulator with the locking clip (fig. 6).

21. Preparation for Flight

a. While the radiosonde is being prepared for flight, inflate the balloon and assemble the balloon train as explained in TM 11-6660-218-12.

b. Prepare all the associated equipment (para 11) that must be used during the flight.

c. Cut the test wires (fig. 5) at different lengths as close to the outside of the modulator as possible. Apply a thin coat of silicone compound over the exposed ends of the test wires.

d. Launch the radiosonde as explained in TM 11-6660-218-12.

APPENDIX A
REFERENCES

The following is a list of applicable publications available to the operator of Radiosonde Set AN/AMT-4D.

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manual (Type 7, 8 and 9), Supply Bulletins, and Lubrication Orders.
DA Pam 310-7	U. S. Army Equipment Index of Modification Work Orders.
TM 11-6625-213-12	Operator and Organizational Maintenance Manual: Test Sets TS-538/U, TS-538A/U and TS-538B/U and TS-538C/U.
TM 11-6660-204-10	Operator's Manual: Radiosonde Recorders AN/TMQ-5, AN/TMQ-5A, AN/TMQ-5B, and AN/TMQ-5C.
TM 11-6660-206-12	Operator's and Organizational Maintenance Manual: Rawin Sets AN/GMD-1A and AN/GMD-1B.
TM 11-6660-218-12	Operator's and Organizational Maintenance Manual: Meteorological Station, Manual AN/TMQ-4.
TM 11-6660-219-12	Operator and Organizational Maintenance Manual Including Repair Parts and Special Tool Lists: Radiosonde Baseline Check Sets AN/GMM-1 and AN/GMM-1A.
TM 11-6660-222-12	Operator and Organizational Maintenance Manual: Meteorological Balloons Thermometers ML-4, ML-5, and ML-7; Psychrometers ML-24 and ML-224; Instrument Shelter, Meteorological S-101/UM; Support, Instrument Shelter MT-1426/UM and Launching Equipments.
TM 38-750	The Army Maintenance Management System (TAAMS).

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USACC (4)
MDW (1)
Armies (2)
Corps (2)
HISA (Ft Monmouth) (43)
Svc Colleges (1)
USASESS (5%)
USAADS (2)
USAFAS (10)
USAARMS (10)
USAIS (2)
USAES (2)
USAINTCS (3)
WRMC (1)
ATS (1)
Fort Gillem (10)
Fort Gordon (10)
Fort Huachuca (10)
WSMR (1)
Fort Carson (5)
Ft Richardson (ECOM Ofc) (2)
Army Dep (1) except
LBAD (14)
SAAD (30)
TOAD (14)
USA Dep (2)
Sig Sec USA Dep (2)
Sig Dep (2)
SigFLDMS (1)
USAERDAA (1)
USAERDAW (1)
MAAG (1)
USARMIS (1)
Units org under fol TOE:
(1 copy each unit)
6-100
6-185
6-186
6-200
6-201
6-300
6-302
6-525
6-526
6-576
6-575
6-700
6-701
7
7-100
11-97
11-98
11-117
11-127
11-500(AA-AC)
17
17-100
29-56
29-134
29-136
37
37-100
39-51
57
67

NG: None
USAR: None
For explanation of abbreviations used, see AR 310-50.

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